

## CLAIMS

### What is Claimed is:

1. An apparatus for obtaining a representative sample from a fluid stream having an isothermal condition, comprising:

a heat pipe having first and second segments, a length, and a main cavity formed along its length;

a conduit having a central passage formed longitudinally therethrough, said conduit formed of thermally conductive material, said conduit situated in communication with said heat pipe;

said first segment of said heat pipe engaging said fluid stream, so as to thermally effect said main cavity of said heat pipe;

whereby sample fluid passing through said conduit from said fluid stream maintains an isothermal condition as it passes through said central passage of said conduit.

2. The system assembly of claim 1, wherein there is further provided a plurality of heat pipes in longitudinal alignment.

3. The system assembly of claim 1 wherein said conduit is integrated within said main cavity of said heat pipe.

4. The system of claim 3, wherein said conduit is surrounded by working fluid and vapor within said main cavity of said heat pipe.

5. The system of claim 1, wherein said heat pipe is integrated into a sample probe structure.

6. The system of claim 5, wherein said sample probe has an external portion, and said first segment of said heat pipe is in thermal sink with said fluid stream, and said second segment of said heat pipe thermally interfaces with said external portion of said sample probe is formed to offset ambient environmental temperature influence on the external portion of said fluid sample probe.
7. The system of claim 6, wherein there is further provided a phase separation membrane formed to remove liquid from a sample gas before entering said conduit.
8. The system of claim 7, wherein said sample probe has first and second ends, and wherein said first end of said fluid sample probe is positioned internal to the fluid stream and a second end is positioned external to said fluid stream.
9. The fluid sample probe of claim 6 wherein the heat pipe is formed within said sample probe structure.
10. An apparatus for obtaining a representative sample from a fluid stream having an isothermal condition, comprising:
  - a vacuum jacket having first and second segments, a length, and a main cavity formed along its length;
  - a conduit having a central passage formed longitudinally therethrough, at least a segment of said conduit situated within said main cavity of said vacuum jacket;
  - said conduit having a first end communicating with said fluid stream;
  - whereby sample fluid passing through said conduit from said fluid stream is insulated by said vacuum jacket so as to maintain an isothermal condition as it passes through said central passage of said conduit.

11. The fluid sample probe assembly of claim 10 wherein the sample passageway is integrated within said vacuum jacket.
12. The fluid sample probe assembly of claim 10 wherein a phase separation membrane is provided in the vicinity of said first end of said conduit to remove liquid from a sample gas from said fluid stream.
13. The fluid sample probe of claim 10 wherein said vacuum jacket is situated with a fluid sample probe having first and second ends, and wherein said first end of said fluid sample probe is positioned internal to said fluid stream, and said second end is positioned external to said fluid stream.
14. The fluid sample probe of claim 10 wherein said vacuum jacket is formed within said fluid sample probe.
15. An apparatus for obtaining a representative sample from a fluid stream having an isothermal condition, comprising:
  - an insulated jacket having first and second segments, a length, and a main cavity formed along its length;
  - a conduit having a central passage formed longitudinally therethrough, at least a segment of said conduit situated within said main cavity of said insulated jacket;
  - said conduit having a first end communicating with said fluid stream;whereby sample fluid passing through said conduit from said fluid stream is insulated by said insulated jacket so as to maintain an isothermal condition as it passes through said central passage of said conduit.

16. The apparatus of claim 15 wherein there is further provided a phase separation membrane engaging said conduit, said phase separation membrane formed to remove liquid from said fluid stream before entering said conduit.
17. The apparatus of claim 15 wherein said apparatus forms a fluid sample probe having first and second ends, said first end of said fluid sample probe in communication with said fluid stream, said second end positioned external to said fluid stream.
18. The fluid sample probe of claim 15 wherein said insulated jacket is insulated with a plastic material.
19. The fluid sample probe of claim 18 wherein the plastic material is Teflon.
20. The fluid sample probe of claim 18 wherein the plastic material is Kynar.
21. The fluid sample probe of claim 18 wherein the plastic material is nylon.
22. The fluid sample probe of claim 18 wherein the plastic material is polypropylene.
23. The fluid sample probe of claim 18 wherein the plastic material is polyethylene.
24. The method of obtaining a sample fluid having an isothermal condition from a fluid stream, comprising the steps of:
  - a. providing an apparatus, comprising:
    - a heat pipe having first and second segments, a length, and a main cavity formed along its length;
    - a conduit having a central passage formed longitudinally therethrough, said conduit formed of thermally conductive material, said conduit situated in communication with said heat pipe;

said first segment of said heat pipe engaging said fluid stream, so as to thermally effect said main cavity of said heat pipe;

- b. positioning said heat pipe to thermally engage said fluid stream such that said heat pipe develops an isothermal condition equivalent to said fluid stream;
- c. allowing said thermally conductive material of said conduit to thermally engage said heat pipe such that said conduit develops an isothermal condition equivalent to said heat pipe;
- d. directing a flow of sample fluid from said fluid stream into said conduit; and
- e. retrieving said sample fluid from said conduit.

25. The method of obtaining a sample fluid having an isothermal condition from a fluid stream, comprising the steps of:

- a. providing an apparatus, comprising:
  - an insulated jacket having first and second segments, a length, and a main cavity formed along its length;
  - a conduit having a central passage formed longitudinally therethrough, at least a segment of said conduit situated within said main cavity of said insulated jacket;
- b. allowing said thermally conductive material of said conduit to thermally engage said fluid stream such that said conduit develops an isothermal condition equivalent to said heat pipe;

- c. directing a flow of sample fluid from said fluid stream into said conduit while allowing said insulated jacket to thermally insulate said conduit from ambient temperature; and
- d. retrieving said sample fluid from said conduit.

26. The method of obtaining a sample fluid having an isothermal condition from a fluid stream, comprising the steps of:

- a. providing an apparatus, comprising:
  - a vacuum jacket having first and second segments, a length, and a main cavity formed along its length;
  - a conduit having a central passage formed longitudinally therethrough, at least a segment of said conduit situated within said main cavity of said vacuum jacket;
- b. allowing said thermally conductive material of said conduit to thermally engage said fluid stream such that said conduit develops an isothermal condition equivalent to said heat pipe;
- c. directing a flow of sample fluid from said fluid stream into said conduit while allowing said vacuum jacket to thermally insulate said conduit from ambient temperature; and
- d. retrieving said sample fluid from said conduit.